shall be capable of operating in the various environments that Section 4 specifies.

## 2.7 Cable Entrance Facility (CEF)

The CEF is the interface between the network and the outside plant network. The CEF provides space for the entrance, splicing, bridging, pressurization, and routing of various cables. The three types of CEFs are the above-surface, subsurface, and a combination of above-surface and subsurface, called the duplex CEF. A duplex CEF typically is used when the MDF is on an upper floor of a building. Each of these CEFs may be either enclosed by walls, partitions, etc., for fire and contamination protection, or unenclosed and thus part of the same environment as the adjacent equipment. The CEF system should be designed to adhere to the building and equipment requirements.

### 2.7.1 CEF Spatial Requirements

O2-38 [39] Designs for the CEF should be compatible with the spatial requirements of the network, i.e., a 3048-mm *(10-ft)* clear height for equipment and associated cabling, and 3810 mm *(12 ft, 6 in)* for the lowest building structural member.

### 2.7.2 CEF Loading Requirements

O2-39 [40] CEF equipment should have a maximum floor load of 700 kg/m$^2$ *(143.4 lb/ft$^2$)*. This applies to floor-supported equipment, and is determined by totaling the weight of all such equipment in the area, including cable, splice cases, and racks, and dividing by the associated floor area. The total weight may be averaged over the entire cable entrance area, including aisles and personnel work areas. The weight of all such equipment should be supported by the floor.

R2-40 [41] Wall-supported CEF equipment shall have a 375-kg/m$^2$ *(76.8-lb/ft$^2$)* maximum weight allowance. The uniform weight allocation is the total weight of CEF equipment divided by the surface area of the wall over which the equipment is placed. The center of gravity of any such wall-supported equipment shall be 406 mm *(16 in)* or less from the surface of the wall (measured perpendicular to the wall). Otherwise, the 375-kg/m$^2$ *(76.8-lb/ft$^2$)* weight allocation shall be proportionately decreased.

### 2.7.3 CEF Equipment Temperature and Humidity Requirements

R2-41 [42] Equipment installed in unenclosed above-surface CEFs that are adjacent to the network shall meet the thermal requirements specified in Section 4.1.

**NOTE** — Enclosed CEFs and unenclosed subsurface CEFs may not have permanent facilities for heating. These facilities may be subjected to low temperatures and moisture conditions outside the requirements of Section 4.1. In an enclosed CEF, these conditions may be controlled by installing a mechanical ventilation system to provide continuous air flow from an air-conditioned part of the building.

## 2.8 Summary of Equipment Allocations

Table 2-1 summarizes equipment vertical space and floor load allocations.

**Table 2-1.** Summary of Equipment Space and Load Allocations

| Equipment | Vertical Space | Floor Load |
|---|---|---|
| **Equipment Frame Area** | | |
| • Frames | Floor to 3048 mm *(Floor to 10 ft)* | 560 kg/m$^2$ *(114.7 lb/ft$^2$)* |
| • CDS | Floor to 3048 mm *(Floor to 10 ft)* | 125 kg/m$^2$ *(25.6 lb/ft$^2$)* |
| **Power Area** - All equipment cabling, bus bars, lights, and installation clearances | Floor to 3048 mm *(Floor to 10 ft)* | 700 kg/m$^2$ *(143.4 lb/ft$^2$)* |
| **Distributing Frame Area** | | |
| • Equipment, cabling, lights, and installation clearances | Floor to 2743 mm *(Floor to 9 ft)* | 675 kg/m$^2$ *(138.3 lb/ft$^2$)* |
| • Via cabling | 2743 to 3048 mm *(9 to 10 ft)* | 25 kg/m$^2$ *(5.1 lb/ft$^2$)* |
| **CEF** - All equipment, cable, and installation clearances | Floor to 3048 mm *(Floor to 10 ft)* | 700 kg/m$^2$ *(143.4 lb/ft$^2$)* |
| **Transient loads** | --- | 50 kg/m$^2$ *(10.2 lb/ft$^2$)* |

## 2.9 Network Equipment at Remote Locations

Remote equipment locations are installations of network telecommunications equipment located outside a network. Aside from installations of network equipment on a customer's premises, there are four basic location types:

- Repeater stations, ranging from enclosures that provide only limited protection from the outside environment to buildings that provide network-level environmental conditions, depending on the equipment housed within them
- Electronic Equipment Enclosures (EEEs) – above-ground and below-ground structures that may provide controlled environmental conditions and generally satisfy the NEBS spatial and environmental requirements
- Commercial buildings and other non-telephone buildings that provide controlled environmental conditions that satisfy the NEBS requirements
- Non-environmentally controlled equipment housings – cabinets with limited environmental controls to provide protection from the outside environment.

In general, network equipment at remote locations shall comply with all the spatial and environmental requirements of this document. Possible exceptions are discussed below.

### 2.9.1 Repeater Stations

Network equipment to be installed in repeater stations should satisfy all the requirements in this document. Any special requirements that deviate from or exceed these generic requirements will be provided in Bellcore generic requirements documents or purchasing specifications for a specific system, equipment, or component.

### 2.9.2 Electronic Equipment Enclosures

Network equipment to be installed in environmentally controlled Remote Terminal (RT) equipment enclosures, such as Controlled Environment Vaults (CEVs), should satisfy the requirements provided in this document. Any special requirements that deviate from or exceed these generic requirements, such as those relating to floor loading limits, aisle widths, equipment access, and overhead cabling, will be provided in Bellcore requirements documents or purchasing specifications for specific systems, equipment or components.

Generic technical requirements for the enclosures themselves are provided in GR-26-CORE, *Generic Requirements for Controlled Environment Vaults (CEVs)*, and TA-NWT-000043, *Generic Requirements for Telecommunications Huts*.

### 2.9.3 Commercial Building Considerations

Network equipment systems also may be used in non-telephone exchange locations, such as commercial buildings. Areas within these buildings that are used exclusively for the installation of exchange and interexchange communication equipment would be under the control of the service provider. These equipment systems should meet the NEBS requirements provided in this document.

Many commercial buildings are not designed to meet the assumed building criteria in this document. The allowable floor loads are less than 725 kg/m$^2$ *(148.5 lb/ft$^2$)* (including transient loads) and a clear ceiling height of less than 3048 mm *(10 ft)* is provided for the installation of equipment frames, cable distribution systems, and lights. Equipment frame layouts, equipment support design, and aisle spacing plans should be referred to the building's structural engineer who should review the structural adequacy of the building to support the equipment system under static and dynamic (seismic as well as low-level vibration) loading conditions. Section 4.5 contains requirements for earthquake and vibration conditions.

Areas dedicated to network telecommunications equipment should be equipped with an Early Warning Fire Detection (EWFD) system with at least one detector per building bay. Avoid using automatic suppression systems directly over telecommunications equipment. Where state or local codes mandate the use of such suppression systems, they should be dry, cross-zoned systems triggered by heat and smoke detectors. All cable penetrations should be 2-hour firestops, and riser cable should be in accord with the NEC by meeting UL Standard 1666, *Standard for Flame Propagation Heights of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*. Flammable materials should not be stored in or near the area dedicated to the network's equipment. The use of a total flooding suppression system is discouraged.

HVAC systems in commercial buildings should provide sufficient capacity to maintain the temperature and relative humidity. Where dehumidifiers are used, most units require a minimum temperature of 15°C *(59°F)* within the limits specified in Section 4.1.2. Suppliers of telecommunications equipment shall specify the heat dissipation rates of their equipment on floor plan data sheets. This data will help building operation personnel implement appropriate cooling schemes.

An objective for the average equipment heat load in COs is 860 W/m$^2$ *(79.9 W/ft$^2$)*. This guideline should also be appropriate for commercial buildings. Heat loads identified as greater than 860 W/m$^2$ *(79.9 W/ft$^2$)* may require special provisioning to maintain space temperatures within the quoted range. Careful planning of the air distribution system is essential to provide uniform temperature throughout the space and enough air flow for removal of the heat from all equipment frames, especially those with relatively large heat loads.

A continuous supply of highly filtered air should be provided to help ensure an environment that is within the limits of airborne contaminants as presented in Section 4.5.

The criteria presented in Section 4.5 are based on conditions found in typical COs where indoor sources of gaseous and particulate contamination are limited. In commercial buildings where manufacturing or chemical processes or administrative activities such as photocopying occur, the added indoor contaminants will increase the need for protection of the telecommunications equipment. It may be necessary to provide a space partitioned from the rest of the building with a separate, dedicated air-conditioning system to provide adequate protection. Some equipment may be susceptible to very small dust particles that can become conductive at relative humidities above 60%. Thus, the control of both dust and humidity become important considerations in any facility with this type of equipment.

GR-1089-CORE includes electrical grounding criteria. It also contains EMC, electrostatic discharge, and electrical safety criteria. These criteria may be applied to equipment areas in commercial buildings.

### 2.9.4 Non-Environmentally Controlled Equipment Housings

Electronic equipment housings without environmental control are generally prefabricated cabinets that are transportable and are normally installed totally above ground on pads or poles. The technical requirements detailing the mechanical and environmental stresses that the cabinets themselves must be able to withstand are in TA-NWT-000487, *Generic Requirements for Electronic Equipment Cabinets*. The Digital Loop Carrier equipment installed inside the cabinets must satisfy the requirements in TR-NWT-000057, *Functional Criteria for Digital Loop Carrier Systems*.

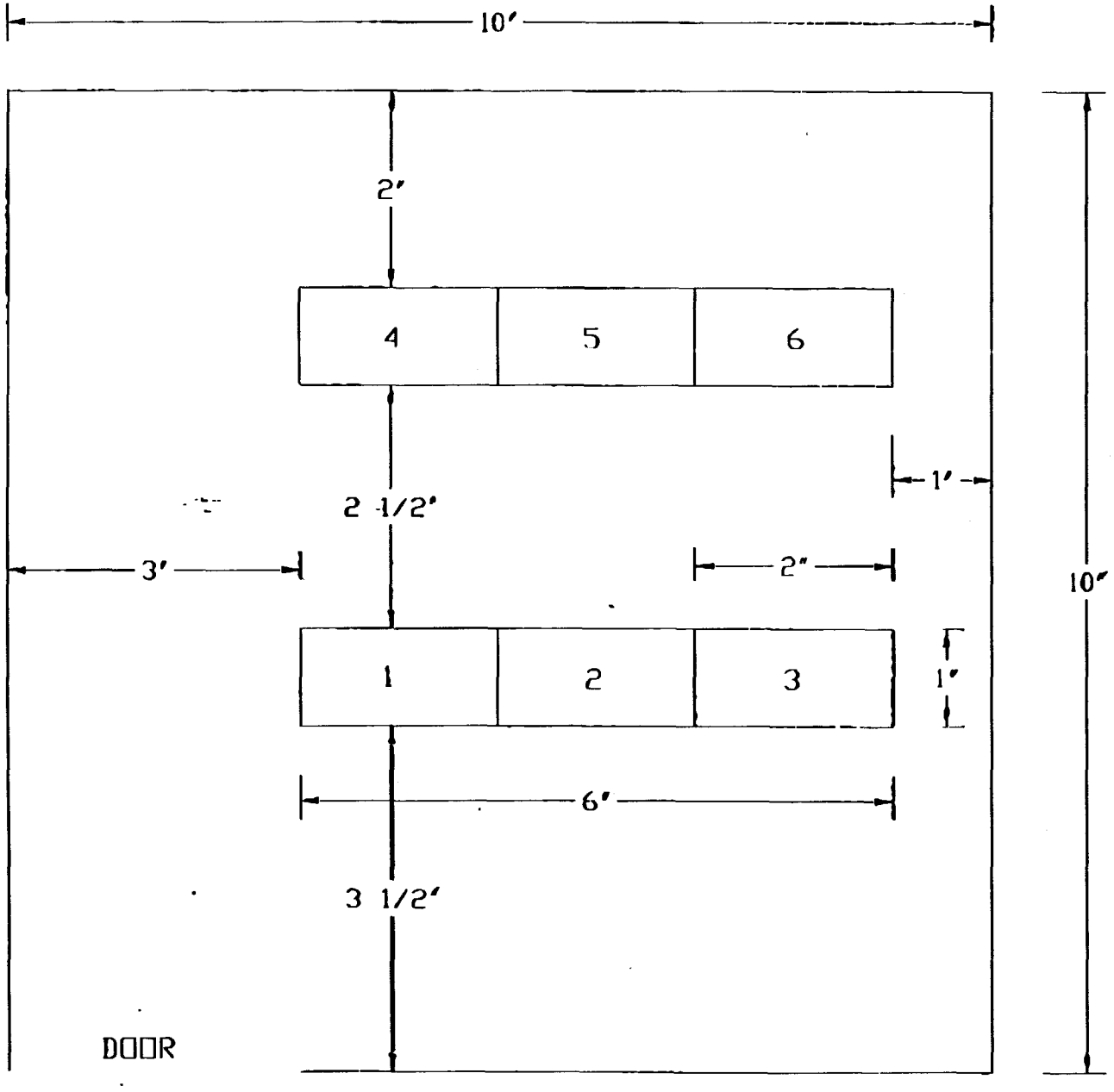
A number of requirements unique to the outside plant environment, such as resistance to corrosion, fungus, water intrusion, ultraviolet radiation, wind, and severe mechanical impact, are contained in TA-TSY-000487. As an example, the cabinet must be able to withstand a simulated brush fire placed at its base and the equipment housed within must show no signs of ignition, melting, burning, or structural damage sufficient to impair service. Further, the cabinets must be equipped with alarms capable of being remoted to an alarm monitoring center for intrusion, high temperature, power failure, and failure of ventilating or heat exchange fans, if present.

Many of the physical and environmental requirements in TR-NWT-000057 simply refer back to NEBS requirements as the main source for environmental requirements of network equipment. The most notable exceptions are the temperature and humidity requirements. Since the equipment is housed in structures with limited environmental controls, the temperature and humidity are much more severe than those for equipment in a CO environment. The equipment must meet all functional criteria when operating within the temperature and humidity range, outside the housing, of -40°C *(-40°F)* with no solar load, to 46°C *(114.8°F)* with maximum heat dissipation and maximum solar load as calculated by the procedure given in TR-NWT-000057, and 5% to 95% RH. With ambient temperatures above 29°C *(84.2°F)*, the relative humidity may be limited to 0.024 kg of water per kg of dry air. In addition, the temperature of the hottest air spaces between the

equipment and cabinet interior surfaces with electronics operating at maximum heat generation under the external temperature conditions stated above, should be limited to a maximum of 65°C *(149°F)*.

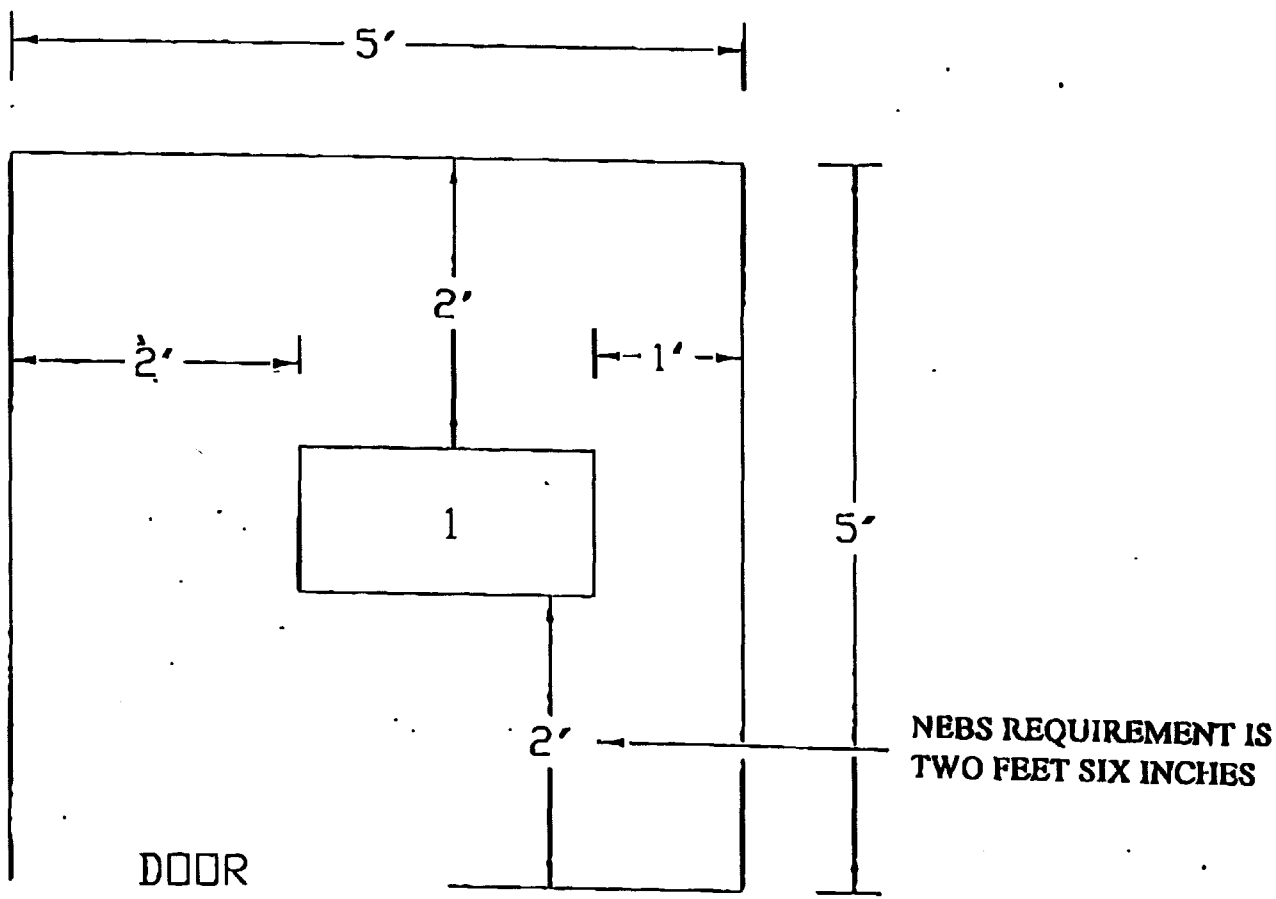
Furthermore, since little or no filtering of outside air is done in these cabinets, the equipment should operate reliably at outdoor urban contamination levels listed in Table 4-11 of this document. If the equipment and housing are supplied together as one system, the total package must meet these levels. If the equipment is supplied alone, it must be able to operate at these levels. The contamination level specified in this section applies to the ambient external to the cabinet.

SINGLE 10 X 10



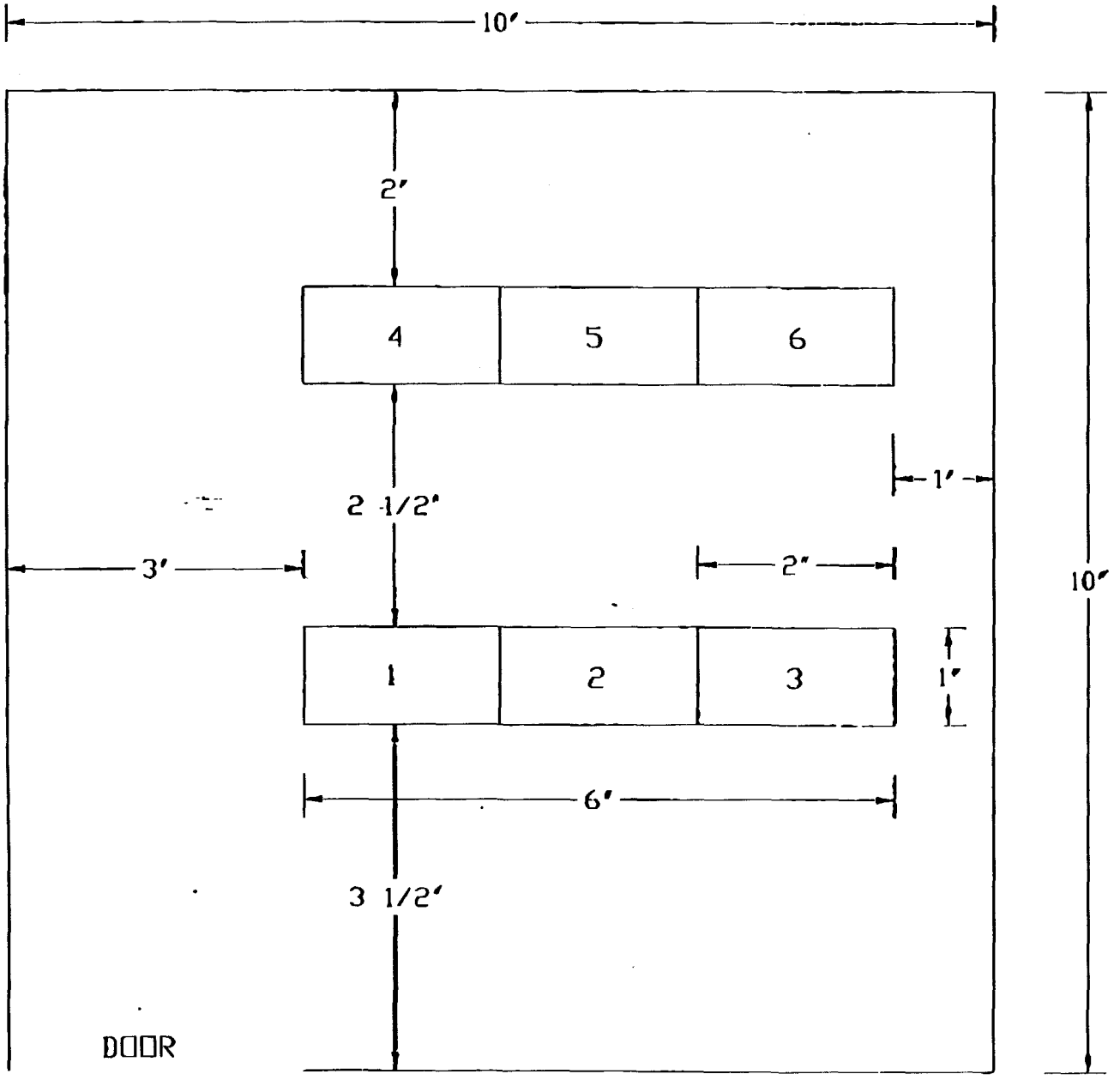

3'-0" X 10'-0" ACCESS WALKWAY

A SINGLE 5 X 5




3'-0" X 5'-0" ACCESS WALKWAY

SINGLE 10 X 10

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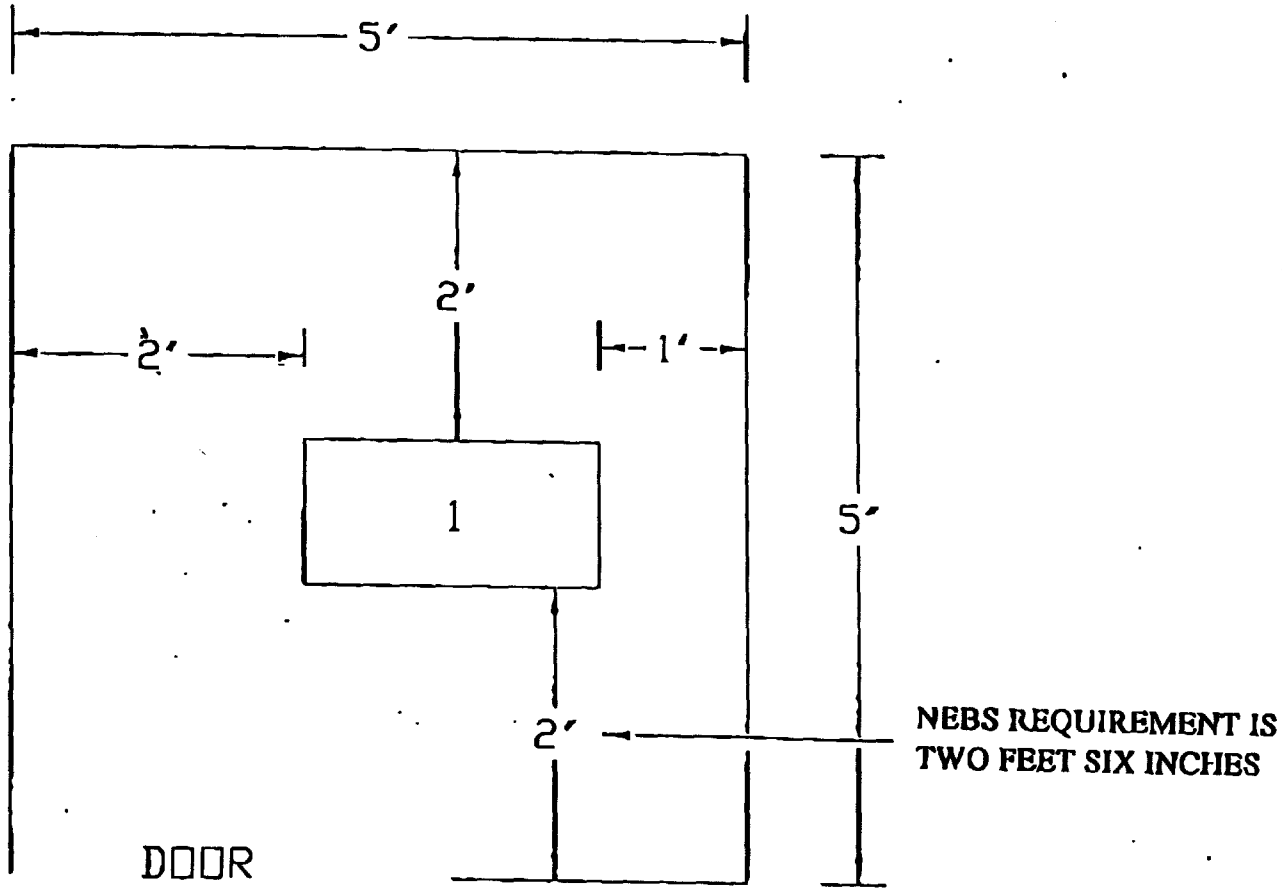
A SINGLE 5 X 5




3'-0" X 5'-0" ACCESS WALKWAY